Alberta
AGRICULTURE

AL.1.871
c2

Volume 6 Number 1 August, 1991

Research Report

Laura Lee Billings says lean Alberta beef should be cooked at slower, lower temperatures for juicy and tender meat

Getting the best from beef

Proper handling by retailers and consumers is the key to great taste

When Laura Lee Billings read the results from a survey by the Beef Information Centre in Calgary, she knew something had to be done. The survey found that one in three Canadians believe beef quality has declined. Hanna District Home Economist Billings knew that beef quality has actually improved through advances such as better cattle breeds and improved feed. She guessed that the real problem could be the way beef is handled from the time it leaves the farm gate until it reaches the consumer's table.

Consumers judge beef quality by its tenderness, juiciness and flavour, but tenderness is the most important factor. Research by Dr. Stephen Morgan Jones at Agriculture Canada's Lacombe Research Station has shown that aging enhances tenderness. During aging, natural enzymes within the meat slowly break down the muscle fibres and the connective tissues, making the meat more tender. Aging for 10 to 14 days is generally recommended. Although retailers usually say they age beef for 10 days, Morgan Jones says, "Quite a considerable portion of the meat [on retail shelves] is not aged for the full 10 days." Unaged and inadequately aged beef contribute to the consumer perception that beef quality is variable and declining.

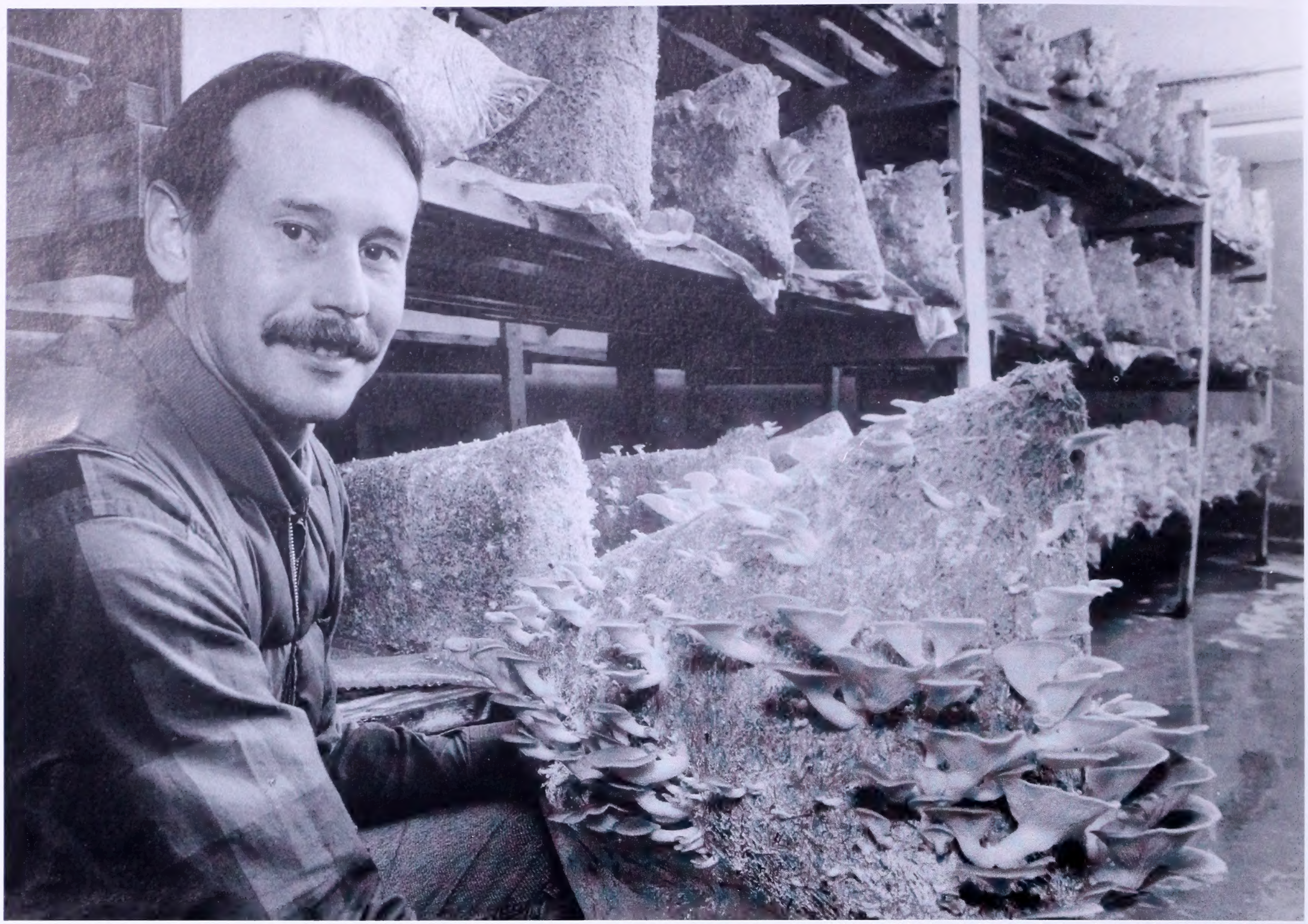
How beef is cooked also affects its tenderness. The new leaner Alberta beef should be cooked slowly at lower temperatures (between 275°F and 325°F, depending on the cut). Unfortunately, many people cook it at 350°F which produces tough, dry meat and makes them think beef quality has declined.

Billings tackled the problem on both fronts: she tested the effects of aging on tenderness and demonstrated better cooking methods. She was able to do this with a grant from Farming for the Future's On-Farm Demonstration Program and the help of Steer-a-Year. The Steer-a-Year competition was a program in which beef producers followed feedlot performance and carcass quality of individual animals. Billings thought a natural extension of Steer-a-Year would be to allow producers to follow their steers to the final buyer and see how retail handling and consumer preparation affected meat quality.

A total of 273 families (102 city families, 89 town families and 82 farm families in south-central Alberta) participated in the demonstration and 92% completed it. The help of Steer-a-Year was a real advantage, says Billings. The group generated excitement and interest in the project, and "it wasn't a lot of work for anyone. Everyone just pitched in and we all got the maximum benefit."

(continued on page 4)

See page 4:
•A landmark development for agricultural research in Alberta



Walter Chipchar holds a bail of ready to pick oyster mushrooms.

Blazing the oyster mushroom trail

A Smoky Lake producer is clearing the way for Alberta's exotic mushroom growers

"I guess pioneers have to clear the bush a little so others will follow," says Walter Chipchar. In his case, bush clearing means applied research and technology transfer at his pioneering operation, Forest Mushrooms. Located on his 330-acre farm near Smoky Lake, Alberta, Forest Mushrooms produces exotic mushrooms—edible mushrooms other than the white button mushroom. And these days, Chipchar is clearing the oyster mushroom trail for the Alberta exotic mushroom industry.

Oyster mushrooms (*Pleurotus* species), so-named because their caps are shaped like oysters, are relatively easy and inexpensive to cultivate and have a delicate, appealing taste. Commercial cultivation is common in many European and Asian countries. In Canada, however, it's still a small industry and much less important than button mushroom production. There's only a handful of Alberta growers and sometimes they have a tough time finding the technical expertise they need. That's where Chipchar's bush clearing comes in.

Forest Mushrooms is a two-person operation housed in a 32-foot by 64-foot "cheap and functional" building designed by Chipchar. It has a laboratory area (for the work which requires sterile conditions) and a production area (with clean but not sterile conditions). In his lab, Chipchar uses tissue culture techniques to grow cultures of the fungus which produces oyster mushrooms. The lab work is rather finicky because the cultures can easily become contaminated if sterile conditions are not maintained. Many growers prefer to purchase bulk cultures from companies like Forest Mushrooms.

To produce a bulk culture, Chipchar takes a small piece of an oyster mushroom and places it in a jar containing a growing medium. The mushroom tissue grows into a white, mat-like fungus. The fungus is then mixed with a litre of grain and sawdust. When it has grown throughout the grain-sawdust mixture, it's ready to be used as a bulk culture, referred to as spawn.

The spawn needs a substrate to grow in so it can produce oyster mushrooms, the fruiting bodies of this fungus. The spawn grows well in such materials as sawdust and straw. In fact, it's able to break down these materials and so, unlike button mushroom production, oyster mushroom production doesn't require prior composting of the substrate. Chipchar uses straw from his farm for his substrate.

The straw is first pasteurized to kill any contaminants and then it's mixed with the spawn and put into clear plastic bags. The bags are left for about two weeks until the fungus completely takes over the straw, producing a whitish, solid mass. Then the bags are transferred to a room where humidity, temperature and air flow are regulated so the fungus will produce mushrooms. The first flush of mushrooms appears seven to 10 days later. New flushes appear in 10-day cycles up to about six to eight times after the first flush (with the earlier flushes producing the most mushrooms). The mushrooms are picked about three days after they appear.

Commercial growers need spawn which produces marketable mushrooms quickly and efficiently. Although oyster mushroom strains can be obtained from

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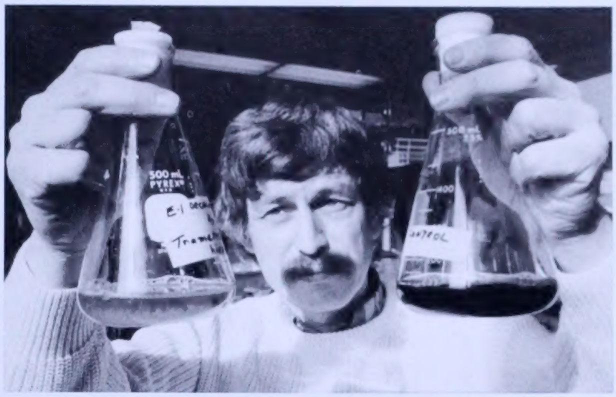
Mighty Decomposers

At Forest Mushrooms, the *Pleurotus* fungus breaks down sawdust and straw in order to grow and produce oyster mushrooms. But this fungus and some other fungi can decompose many other wastes. This remarkable ability has spurred the Alberta Environmental Centre's interest in fungi.

As a sideline of its work on waste treatment, AEC has been involved in research on exotic mushroom cultivation for about six years, says Dr. Steve Davies, Head of AEC's Biotechnology Section. This Section's mandate is to perform research into biological methods of waste treatment. By cultivating exotic mushrooms, he says, "we're treating waste products from agriculture and the forest products industry....I can take a ton of airdried sawdust and convert it to $10,000 worth of mushrooms at very little cost in terms of processing."



Davies compares fungi-treated pulp mill effluent (left) with untreated effluent

AEC provides some support to Alberta's fledgling exotic mushroom industry. It maintains a collection of fungi, it collects articles on exotic mushrooms and it held a workshop for growers and would-be growers on cultivation techniques and marketing. As well, Davies has done some research with Alberta Agriculture. For example, in cooperation with the Alberta Tree Nursery and Horticulture Centre at Oliver, he grew oyster mushrooms in greenhouses. He thinks this has excellent potential: "Greenhouses raise plants for a particular time of year—like poinsettias for the Christmas market—but for over half the year, the greenhouses are empty. One possible use for these empty spaces is oyster mushroom cultivation."

This agricultural sideline is carried out completely separately from the Biotechnology Section's mainstream research on using fungi to treat toxic wastes, like pulp mill effluent (see photo) and PCBs.

Why are these fungi able to break down toxic wastes? "In nature, the cells of these fungi gain nutriment by breaking down cellulose in dead tree trunks," explains Davies. "Wood is composed primarily of cellulose and lignin. The fungi break down the cellulose into its constituent sugar molecules and use the sugar as a source of energy for producing new cells. But these particular fungi also have the capability of breaking down lignin, which is far more resistant to biological breakdown than cellulose. They have a special enzyme called ligninase that breaks down lignin. Ligninase can also break down a wide variety of toxic organic molecules—PCBs, DDT, dioxin—all the undesirables you hear about. It's this capability we're trying to harness."

Davies and his staff are currently trying to develop a way to use these fungi to clean up soils contaminated by PCB spills (in a project funded by the Alberta Special Waste Management Corporation through Chem-Security (Alberta) Ltd.). Alternative methods of cleaning these sites are expensive, says Davies, and "if we can clean them up biologically, we can do it at much less cost and in a far more environmentally friendly way."

various culture collections, these strains are not necessarily the most useful for growers. Microbiologist and mushroom-lover Dr. Steve Davies of the Alberta Environmental Centre notes that many strains in culture collections are kept for research rather than commerical purposes. As well, commercial spawn producers may not wish to add their strains to a culture collection because the strains would be accessible to their competitors.

To develop better spawn, Chipchar tested about 20 strains of *Pleurotus sajor-caju* (the type of oyster mushroom he usually grows) and found the three with the best commercial potential. Then, with funds from Farming for the Future's On-Farm Demonstration Program, he selected the best one of these three strains and also evaluated two types of substrates.

> *"There is a great market for these mushrooms right now. It's a sellers' market....here in Alberta, in Toronto, down in the States."*

Chipchar compared wheat straw, his usual substrate, with canola straw. He found the canola straw "was difficult to handle, and tended to leave pockets of dryness on the surface where you're trying to maintain a uniform humidity to encourage cropping." The result was lost production time which could be costly in a tightly scheduled commercial operation. The wheat straw was easy to handle and stayed evenly moist. Wheat straw also produces very good yields: Chipchar has had up to 1.5 lbs of mushrooms produced per pound of wheat straw.

He obtained the three strains of *Pleurotus sajor-caju* for his project from the Alberta Environmental Centre (AEC) in Vegreville (see sidebar). He first selected the most vigorous cultures from each of the three strains and used these to produce the spawn for each strain. He then compared the three strains and found the one with the most consistent mushroom yields.

Through this project and his previous work, Chipchar has developed spawn which has not only more consistent yields but also shorter production times and mushrooms with a specific size (a few inches across) and colour (off-white) to appeal to Alberta consumers.

Along with his applied research, Chipchar's "bush clearing" includes teaching people about the joys of cultivating and consuming oyster mushrooms. It's easy to be converted when he serves up a dish of delicious sautéed oyster mushrooms while explaining that the production process is fairly simple, the input costs are relatively low and the returns are good. He estimates a few hundred people have taken courses from him and he is currently working closely with several new commercial growers to set up facilities.

AEC's Davies agrees with Chipchar on the commercial potential for oyster mushroom production. He says oyster mushrooms cost less to produce but sell for much more than button mushrooms. In Edmonton, for example, oyster mushrooms sell for about $7.00/lb while button mushrooms sell for $1.99/lb. As the market for ethnic and specialty foods grows, things can only get better, he says. "There is a great market for these mushrooms right now. It's a sellers' market....here in Alberta, in Toronto, down in the States."

With a bit more bush clearing, oyster mushroom production could become a small pearl, you might say, in Alberta's agricultural industry. In economic terms, it could provide an alternative on-farm income source. In environmental terms, the process converts locally available agricultural wastes into valuable mushrooms. (And even the used substrates aren't wasted: Chipchar gives his to local market gardeners for use in their soil mixtures and he says they've been getting great results.) In gastronomic terms, oyster mushrooms are yummy cooked in a casserole, on a pizza, sautéed with a little butter and garlic, or fresh—you can use them like "little shovels," says Chipchar, to scoop up your favourite dip.

(*continued from page 1*)

Three steers were purchased from Steer-a-Year, which raised and shipped the steers from one feedlot. This eliminated any variations in carcass quality due to ration, stress of handling, length of feeding and slaughtering environment. To test the effect of aging on meat quality, one-half of each beef carcass was aged for three days, and the other half was aged for 14 days. Four different cuts were evaluated in the study: T-bone, rib steak, sirloin steak and chuck steak. Participants were given steaks and asked to assess juiciness, flavour, tenderness and overall impression. The results showed a significant preference for the beef aged 14 days for each of the four cuts.

Participants were also requested to use specific cooking techniques to improve the eating quality of the steaks. Many participants said they didn't really know how to prepare beef before they took part in the project. "A lot of the people bought only hamburger because they didn't know how to cook beef—especially the less tender cuts—for the best results," says Billings. Eighty two percent of the participants indicated they would continue to use the slower, lower cooking temperatures recommended.

One of the project's participants was Dianne Quaschnick. She and her husband Marvin have a beef cattle operation 10 miles south of Hanna and her husband was on the Steer-a-Year organizing committee. She enjoyed being part of the project: "It was no problem. Eating meat that's free—what could be easier?" Like a lot of other people involved in the project, she has changed the way she prepares steak and other cuts of beef. She now cooks her roasts at 275°F and they turn out "just beautiful."

Don Milligan, the Alberta Agriculture Regional Livestock Specialist in Airdrie, has also changed his cooking habits. He was astonished when he first heard about cooking a roast at 275°F, "but I do that all the time now. It's way better. Even an old dog like me can learn something new!" He also hopes Billings' project has made producers aware of the need to be concerned about what happens to their beef beyond the farm gate.

For Billings, the demonstration achieved its goals. It supported the research being conducted at Lacombe by showing the significant effect of aging on tenderness. And it has helped improve the way many consumers prepare their beef. Says Billings: "The real plus of this project was that it directly involved so many people. They could see how easy it is to prepare beef at the lower temperatures and could taste the improvement in eating quality."

For further information on preparing beef, contact the Beef Information Centre, #238, 2116 - 27 Avenue NE, Calgary, Alberta T2E 7A7.

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Landmark Merger

by Bob Bogle

Chairman of the Board Alberta Agricultural Research Institute

I am extremely pleased to announce that, as of April 1, 1991, Farming for the Future has been merged with the Alberta Agricultural Research Institute. The name "Farming for the Future" will continue to be synonymous with research and development in agriculture.

Farming for the Future was initiated over a decade ago as an Alberta Heritage Savings Trust Fund program to fund agricultural research and technology transfer. Farming for the Future has generated many valuable advances for Alberta's agri-food industry. The program has supported 684 research projects and 741 demonstration projects. A consultant's study indicates that the economic benefits of these projects to the agriculture and food industry, consumers and the provincial economy as a whole will exceed $900 million over the next 25 years. These successes have been built through important individual efforts as well as an impressive level of cooperation among producers, the private sector, academic institutions, and the Alberta and federal governments.

Farming for the Future's achievements through cooperation in agricultural research and technology transfer sowed the seed for the concept of the Alberta Agricultural Research Institute.

The Institute is a Crown corporation governed by a Board of Directors. It was established by an Act of the Alberta Legislature in 1987 to coordinate, promote and support research in agriculture. Cooperative research projects, coordinated research funding and joint priority setting are cornerstones of the Institute's efforts.

Since its creation, the Institute has worked closely with the Farming for the Future Council. Given their shared aim of enhancing the sustainability of Alberta's agri-food industry through research and technology transfer, it was natural for the two agencies to eventually unite.

I found it very appropriate that the merger came into effect in the spring, a time of renewal and growth. It is both a reaffirmation of Farming for the Future's importance and a significant step in the evolution of the Institute. Significant because it consolidates, streamlines and strengthens the Alberta Government's support for agri-food research.

A number of measures have been taken to ensure that Farming for the Future and the Institute continue to function smoothly and efficiently. The administration of Farming for the Future has been transferred from the Farming for the Future Council (the former administrative body of Farming for the Future) to the Institute. Representatives of the Council have been appointed to the Institute Board and the Council has been disbanded. A significant number of the previous members of Farming for the Future's research committees have been appointed to the Institute's research and strategic committees. The structure of the On-Farm Demonstration Program, Farming for the Future's technology transfer program, remains unchanged. And finally, to maintain continuity, administrative staff from Farming for the Future are now part of the Institute and will continue to be involved in the operation of Farming for the Future and the Institute's other programs.

These other programs include the Matching Grants Program, the Research Coordination Program and the Research Professorship Program. The Institute also manages Alberta's participation in the National Agricultural Biotechnology Initiative. The addition of the Farming for the Future Research Program and the On-Farm Demonstration Program will certainly expand and intensify the Institute's responsibilities in research funding and technology transfer.

As to the future of Farming for the Future, it is currently in the final year of a five-year mandate which ends March 31, 1992. I am optimistic that, based on Farming for the Future's strong record of performance, the Alberta Government will approve a new mandate for the program beyond 1992.

The Alberta Agricultural Research Institute, with Farming for the Future as an integral part of its operations, is now the primary agricultural research granting and coordinating agency of the Government of Alberta. With this merger, we will witness even greater progress in agricultural research that will benefit Alberta's agricultural producers, processors and consumers for many years to come.